

05-071**DEPARTMENT OF EDUCATION****Chapter 131: The Maine Federal, State, and Local Accountability Standards**

SUMMARY: This chapter outlines the Maine Federal, State, and Local Accountability Standards pursuant to Title 20-A M.R.S.A §6208 and §6209. The Maine Federal, State and Local Accountability Standards define the State's accountability standards and performance indicators. These standards and performance indicators are described for the content areas of Mathematics, Reading, and Science. Each of the content areas is organized in one or more standards. The standards articulate the state's overarching learning expectations for the content area. Standards are further detailed by performance indicators which outline grade span/grade level expectation for the each of the standards.

The Maine *Learning Results* addressed in Appendix A, which serve as the basis for Maine's Grade Level Expectations, will remain in effect until the end of the 2007-2008 school year. At the beginning of the 2008-2009 school year school administrative units must fully implement the Maine Federal, State, and Local Accountability Standards as outlined in the Chapter.

1. ENGLISH LANGUAGE ARTS**CONTENT STANDARDS AND PERFORMANCE INDICATORS**

1.1 READING: Students read to comprehend, interpret, analyze, evaluate, and appreciate literary and expository texts, within a grade appropriate span of text complexity, by using a variety of strategies. They connect essential ideas, evaluate arguments, and analyze the various perspectives and ideas presented in a variety of literary and expository texts.

Interconnected Elements: Comprehension, Vocabulary, Alphabetics, Fluency

Grades Pre-K-2

1.1.1 Students read from texts, within a grade appropriate span of text complexity, and apply their knowledge and strategies of comprehension, vocabulary, alphabetics, and fluency.

Grade 3

1.1.2 Students read and draw conclusions from texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabetics, and fluency.

Grade 4

1.1.3 Students read and draw conclusions from texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabetics, and fluency.

Grade 5

1.1.4 Students read and draw conclusions from texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabets, and fluency.

Grade 6

1.1.5 Students read and make generalizations about texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabets, and fluency.

Grade 7

1.1.6 Students read and make generalizations about texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabets, and fluency.

Grade 8

1.1.7 Students read and make generalizations about texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabets, and fluency.

Grades 9-Diploma

1.1.8 Students read and evaluate texts, within a grade appropriate span of text complexity, by applying their knowledge and strategies of comprehension, vocabulary, alphabets, and fluency.

Literary Texts**Grades Pre-K-2**

1.1.9 Students read fiction, nonfiction, drama and poetry within a grade appropriate span of text complexity.

Grade 3

1.1.10 Students read fiction, nonfiction, drama, and poetry within a grade appropriate span of text complexity.

Grade 4

1.1.11 Students read fiction, nonfiction, drama, and poetry within a grade appropriate span of text complexity.

Grade 5

1.1.12 Students read fiction, nonfiction, drama, and poetry within a grade appropriate span of text complexity.

Grade 6

1.1.13 Students read fiction, nonfiction, drama, and poetry, within a grade appropriate span of text complexity, and analyze the

characteristics noting how structural features and common literary devices help shape the reader's response.

Grade 7

1.1.14 Students read fiction, nonfiction, drama, and poetry, within a grade appropriate span of text complexity, and analyze the characteristics noting how structural features and common literary devices help shape the reader's response.

Grade 8

1.1.15 Students read fiction, nonfiction, drama, and poetry, within a grade appropriate span of text complexity, and analyze the characteristics, noting how structural features and common literary devices help shape the reader's response.

Grades 9-Diploma

1.1.16 Students read fiction, nonfiction, drama, and poetry, within a grade appropriate span of text complexity, and present analyses using excerpts from the text to defend their assertions.

Informational Texts

Grades Pre-K-2

1.1.16 Students read informational texts, within a grade appropriate span of text complexity, for different purposes.

Grade 3

1.1.17 Students read and summarize informational texts, within a grade appropriate span of text complexity, for different purposes.

Grade 4

1.1.18 Students read, paraphrase, and summarize informational texts, within a grade appropriate span of text complexity, for different purposes.

Grade 5

1.1.19 Students read, paraphrase, and summarize informational texts, within a grade appropriate span of text complexity, for different purposes.

Grade 6

1.1.20 Students read various informational texts, within a grade appropriate span of text complexity, making decisions about usefulness based on purpose, noting how the text structures affect the information presented.

Grade 7

1.1.21 Students read various informational texts, within a grade appropriate span of text complexity, making decisions about usefulness based on purpose, noting how the text structures affect the information presented.

Grade 8

1.1.22 Students read multiple informational texts, within a grade appropriate span of text complexity, making decisions about usefulness based on purpose, noting how the text structures affect the information presented.

Grades 9-Diploma

1.1.23 Students evaluate the validity, truthfulness and usefulness of ideas presented in informational texts, within a grade appropriate span of text complexity, noting how the text features and text structures affect the information presented.

Persuasive Texts

Grades Pre-K-2

No performance indicator.

Grade 3

1.1.24 Students read persuasive texts, within a grade appropriate span of text complexity, to analyze the persuasive writing.

Grade 4

1.1.25 Students read persuasive texts, within a grade appropriate span of text complexity, to analyze the persuasive writing.

Grade 5

1.1.26 Students read persuasive texts, within a grade appropriate span of text complexity, to analyze the persuasive writing.

Grade 6

1.1.27 Students evaluate the information in persuasive texts, within a grade appropriate span of text complexity, noting how the structural features and rhetorical devices affect the information and arguments presented in these texts.

Grade 7

1.1.28 Students evaluate the information in persuasive texts, within a grade appropriate span of text complexity, noting how the structural features and rhetorical devices affect the information and arguments presented in these texts.

Grade 8

1.1.29 Students evaluate the information in persuasive texts, within a grade appropriate span of text complexity, noting how the text structures and rhetorical devices affect the information and arguments presented in these texts.

Grades 9-Diploma

1.1.30 Students evaluate the validity, truthfulness and usefulness of ideas presented in persuasive texts, within a grade appropriate span of text complexity, noting how the text structures and rhetorical devices affect the information and argument(s) presented.

2. MATHEMATICS

CONTENT STANDARDS AND PERFORMANCE INDICATORS

2.1 NUMBER: Students use numbers in everyday and mathematical contexts to quantify or describe phenomena, develop concepts of operations with different types of numbers, use the structure and properties of numbers with operations to solve problems, and perform mathematical computations. Students develop number sense related to magnitude, estimation, and the effects of mathematical operations on different types of numbers. It is expected that students use numbers flexibly, using forms of numbers that best match a situation. Students compute efficiently and accurately. Estimation should always be used when computing with numbers or solving problems.

Whole Number

Grades Pre-K-2

2.1.1 Students understand and use number notation and place value to 1000 in numerals.

2.1.2 Students understand and use procedures to add and subtract whole numbers with one and two digits.

Grade 3

2.1.3 Students understand and use number notation and place value to 10,000 in numerals.

2.1.4 Students understand and use procedures to add and subtract whole numbers with up to four digits.

2.1.5 Students understand and apply meanings of multiplication and division.

Grade 4

2.1.6 Students understand and use number notation and place value to 100,000.

2.1.7 Students understand and use the concepts of factor and multiple.

2.1.8 Students understand and use procedures to multiply and divide whole numbers by two-digit numbers.

Grade 5

2.1.9 Students understand and use number notation to 10 million in numerals and words.

2.1.10 Students multiply and divide numbers up to four digits by numbers up to 2 digits, and by tens, hundreds, and thousands and interpret any remainders.

2.1.11 Students solve problems requiring multiple operations addition, subtraction, multiplication and division and use the conventions of order of operations (no exponents expected).

Grade 6

2.1.12 Students use factors and multiples.

Grade 7

No performance indicator.

Grade 8

No performance indicator.

Grades 9-Diploma

No performance indicator.

Rational Number

Grades Pre-K-2

2.1.13 Students recognize unit fractions including $\frac{1}{2}$, $\frac{1}{4}$, and $\frac{1}{3}$.

Grade 3

2.1.14 Students recognize, name, compare, illustrate and use simple fractions.

Grade 4

2.1.15 Students understand, name, compare, illustrate, combine and use fractions.

2.1.16 Students understand and use number notation and place value in numbers with two decimal places in real world contexts including money.

Grade 5

2.1.17 Students understand, name, compare, illustrate, compute with and use fractions.

2.1.18 Students understand and use number notation and place value in numbers with three decimal places.

2.1.19 Students understand concepts of positive and negative integers.

Grade 6

2.1.20 Students express fractions greater than 0 as decimals and compare positive fractions and decimals numbers and place them on the number line.

2.1.21 Students add, subtract, and multiply, and divide numbers expressed as fractions and as decimals including mixed numbers.

2.1.22 Students understand how to express relative quantities as percentages and as decimals and fractions.

2.1.23 Students multiply and divide decimals with up to 3-decimal places by tens, hundreds, and thousands.

Grade 7

2.1.24 Students use negative and positive rational numbers expressed as integers, fractions and decimals.

2.1.25 Students compute with signed rational numbers.

2.1.26 Students understand that when the ratio of two varying quantities is constant, the two quantities are in direct proportion.

2.1.27 Students interpret and use percents to solve problems.

Grade 8

2.1.28 Students express or interpret numbers using scientific notation from real-life contexts.

Grades 9-Diploma

No performance indicator.

Real Number

Grades Pre-K-2

No performance indicator.

Grade 3

No performance indicator.

Grade 4

No performance indicator.

Grade 5

No performance indicator.

Grade 6

No performance indicator.

Grade 7

No performance indicator.

Grade 8

2.1.29 Students understand the set of real numbers as containing the rational numbers and the irrational numbers.

Grades 9-Diploma

2.1.30 Students know how to represent and use real numbers.

2.2 DATA: Students make measurements and collect, display, evaluate, analyze and compute with data to describe or model phenomena and to make decisions based on data. Students compute statistics to summarize data sets and use concepts of probability to make predictions and describe the uncertainty inherent in data collection and measurement. It is expected that when working with measurements students:

- Understand that most measurements are approximations and that taking repeated measurements reveals this variability.
- Understand that a number without a unit is not a measurement. Thus an appropriate unit must always be attached to a number to provide a measurement.
- Understand that the precision and accuracy of a measurement depends on selecting the appropriate tools and units.
- Use estimation comparing measures to benchmarks appropriate to the type of measure and units.

Measurement and Approximation**Grades Pre-K-2**

2.2.1 Students understand and use units of time, temperature, and money.

Grade 3

2.2.2 Students understand and use measurement of time and temperature.

Grade 4

2.2.3 Students understand and use measurement of time, capacity and temperature.

Grade 5

2.2.4 Students understand and use measures of elapsed time, temperature, capacity, mass and weight.

Grade 6

2.2.4 Students convert within measurement systems.

Grade 7

No performance indicator.

Grade 8

2.2.5 Students understand and use derived measures (measurements expressed as rates).

2.2.6 Students convert across measurement systems and within a system for different units in derived measures.

Grades 9-Diploma

2.2.7 Students understand the relationship between precision and accuracy.

Data Analysis**Grades Pre-K-2**

2.2.8 Students read, construct and interpret picture graphs.

Grade 3

2.2.9 Students read, construct and interpret bar graphs.

Grade 4

2.2.10 Students collect and represent data in tables, line plots, and bar graphs, and read and *interpret* these types of data displays.

Grade 5

2.2.11 Students read, construct and interpret line graphs.

2.2.12 Students find and use median, mode, and range for a set of data.

Grade 6

2.2.13 Students read and interpret pie charts.

2.2.14 Students find and compare the mean, median, mode and range for sets of data.

Grade 7

2.2.15 Students use graphs and charts to represent, organize, interpret, and draw inferences from data.

Grade 8

2.2.16 Students use the mean, median, mode, range, and quartiles to solve problems involving raw data and information from data displays.

Grades 9-Diploma

2.2.17 Students understand correlation and cause and effect.

2.2.18 Students understand and know how to describe distributions and find and use descriptive statistics for a set of data.

2.2.19 Students understand that the purpose of random sampling is to reduce bias when creating a representative sample for a set of data.

Probability

Grades Pre-K-2

No performance indicator.

Grade 3

No performance indicator.

Grade 4

No performance indicator.

Grade 5

No performance indicator.

Grade 6

No performance indicator.

Grade 7

2.2.20 Students understand and apply concepts of probability to simple events.

Grade 8

2.2.21 Students understand and apply concepts of probability.

Grades 9-Diploma

2.2.22 Students understand the relationship of probability to relative frequency and know how to find the probability of compound events.

2.3 GEOMETRY: Students use measurement and observation to describe objects based on their sizes and shapes, model or construct two- and three-dimensional objects, solve problems involving geometric properties,

compute areas and volumes based on object properties and dimensions, and perform transformations on geometric figures. When making or calculating measures, students use estimation to check the reasonableness of results.

Geometric Figures

Grades Pre-K-2

2.3.1 Students recognize, classify and create geometric figures in two and three dimensions.

Grade 3

2.3.2 Students identify, describe, and classify familiar two-dimensional shapes.

Grade 4

2.3.3 Students identify and name angles, lines, relationships between lines, quadrilaterals, and triangles.

Grade 5

2.3.4 Students identify, describe and classify solid figures.

Grade 6

2.3.5 Students represent solid figures in two dimensions.

Grade 7

2.3.6 Students understand angle properties of lines in the plane.

Grade 8

2.3.7 Students know and use properties of polygons.

2.3.8 Students know and use angle properties of parallel lines to solve problems and determine geometric relationships.

2.3.9 Students know and use the Pythagorean Theorem.

Grades 9-Diploma

2.3.10 Students justify statements about polygons and solve problems.

2.3.11 Students justify statements about circles and solve problems.

2.3.12 Students understand and use basic ideas of trigonometry.

Geometric Measurement

Grades Pre-K-2

2.3.13 Students understand how to measure length and capacity and use appropriate units.

Grade 3

2.3.14 Students understand how to find the distance around a figure.

Grade 4

2.3.15 Students understand the concept of area of a figure.

Grade 5

2.3.16 Students find the area of triangles and quadrilaterals.

2.3.17 Students understand how to find the volume and surface area of rectangular prisms.

2.3.18 Students understand how to describe position and direction in two dimensions

Grade 6

2.3.19 Students find the perimeters and areas of geometric figures.

2.3.20 Students find the volume and surface areas of right prisms with bases that are triangles and quadrilaterals.

Grade 7

2.3.21 Students solve problems involving perimeter and area.

Grade 8

2.3.22 Students find the volume and surface area of prisms, pyramids, cylinders, and other figures composed of these solids.

Grades 9-Diploma

2.3.23 Students find the surface area and volume of 3-D objects.

Transformations

Grades Pre-K-2

No performance indicator.

Grade 3

No performance indicator.

Grade 4

2.3.24 Students recognize congruent figures and line symmetry in figures.

Grade 5

2.3.25 Students reflect, slide and rotate plane figures.

Grade 6

2.3.26 Students understand and use reflections, rotations, and translations to define and identify congruent plane figures.

2.3.27 Students understand how to use proportional relationships to make indirect linear measurements and use scale drawings to make linear measurements.

Grade 7

2.3.28 Students understand and use the concept of scale drawings to enlarge or reduce two dimensional plane figures.

Grade 8

No performance indicator.

Grades 9-Diploma

No performance indicator.

2.4 ALGEBRA: Students use symbols to represent or model quantities, patterns and relationships and use symbolic manipulation to evaluate expressions and solve equations. Students solve problems using symbols, tables, graphs and verbal rules choosing the most effective representation and converting among representations.

Symbols and Expressions

Grades Pre-K-2

2.4.1 Students understand how to represent quantities as simple expressions using addition and subtraction.

Grade 3

2.4.2 Students use equivalent expressions to aid computation such as knowing that $43 + 56$ is the same as $40 + 3 + 50 + 6$.

Grade 4

2.4.3 Students create and evaluate simple expressions in the context of numbers and operations as described in Standard A: Number for this grade level.

Grade 5

2.4.4 Students create and evaluate simple expressions in the context of numbers and operations as described in Standard A: Number for this grade level.

Grade 6

2.4.5 Students create and evaluate expressions.

Grade 7

2.4.6 Students create and evaluate expressions.

Grade 8

2.4.7 Students create, evaluate and manipulate expressions.

Grades 9-Diploma

2.4.8 Students understand and use polynomials, and expressions with rational exponents.

Equations and Inequalities

Grades Pre-K-2

2.4.9 Students understand that the equal sign means, “is the same as.”

Grade 3

2.4.10 Students find the unknown in simple equations (or open sentences) in the context of numbers and operations as described in Standard A: Number for this grade level such as:

$$\begin{aligned} 3 + 5 &= [] + 3 \\ 3 + 9 &= [] + 10 \\ [] + () &= 10 \end{aligned}$$

Grade 4

2.4.11 Students find the unknown in simple equations in the context of numbers and operations as described in Standard A: Number for this grade level such as:

$$\begin{aligned} 3 \bullet b &= 12 \\ 3 + 4 &= x + 5 \\ 6 \times 5 &= 3 \times [] \end{aligned}$$

Grade 5

2.4.12 Students find the unknown in simple equations in the context of numbers and operations as described in Standard A: Number for this grade level such as:

$$\begin{aligned} 39 - k &= 39 - 40 \\ 78 + b &= 57 + 79 \\ 30 \times A &= 276 \\ (3 + 4) \times 6 &= 6 \times [] \\ 3 \times 15 &= 3 \times (10 + []) \end{aligned}$$

Grade 6

2.4.13 Students recognize and solve problems involving linear equations and recognize examples and non-examples of linear equations.

Grade 7

2.4.14 Students understand and solve problems involving linear equations and know that a linear equation can be written in the form $0 = ax + b$.

Grade 8

2.4.15 Students understand and solve problems involving linear equations.

2.4.16 Students understand and solve linear inequalities in one unknown.

Grades 9-Diploma

2.4.17 Students solve families of equations and inequalities.

2.4.18 Students understand and apply ideas of logarithms.

Functions and Relations

Grades Pre-K-2

2.4.19 Students understand how to create, identify, describe, and extend patterns given a pattern or a rule.

Grade 3

2.4.20 Students understand arithmetic relationships among positive whole numbers.

2.4.21 Students create, describe, explain and extend patterns with numbers and geometric objects.

Grade 4

2.4.22 Students use tables, rules, diagrams and patterns to represent the relationship between quantities and to extend sequences.

Grade 5

2.4.23 Students use tables, rules, diagrams, and graphs to represent and analyze the relationship between quantities.

Grade 6

2.4.24 Students use tables, formulas, diagrams, and graphs to analyze relationships between quantities.

Grade 7

2.4.25 Students understand and use directly proportional relationships, $y = kx$.

Grade 8

2.4.26 Students understand and use the basic properties of linear relationships, $y = kx + b$.

Grades 9-Diploma

2.4.27 Students understand and interpret the characteristics of functions using graphs, tables and algebraic techniques.

2.4.28 Students express relationships recursively and use iterative methods to solve problems.

3. SCIENCE AND TECHNOLOGY

CONTENT STANDARDS AND PERFORMANCE INDICATORS

3.1 THE PHYSICAL SETTING: Students understand the universal nature of matter, energy, force and motion, and identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

UNIVERSE AND SOLAR SYSTEM

Grades Pre-K-2

3.1.1 Students describe the movement of objects across the sky, as seen from the Earth.

Grades 3-5

3.1.2 Students describe the positions and apparent motions of different objects in and beyond our solar system, and how these objects can be viewed from Earth.

Grades 6-8

3.1.3 Students explain the movements, and describe the location, composition, and characteristics of our solar system and vast universe, including planets, the sun, and galaxies.

Grades 9-Diploma

3.1.4 Students explain the physical formation and changing nature of our universe and solar system, and how our past and present knowledge of the universe and solar system developed.

EARTH

Grades Pre-K-2

3.1.5 Students describe Earth's weather and surface materials and the different ways they change.

Grades 3-5

3.1.6 Students describe the properties of Earth's materials, the processes that change them, and cycles that affect the Earth.

Grades 6-8

3.1.7 Students discuss the various cycles, physical and biological forces and processes, position in space, energy transformations, and human actions that affect short-term and long-term changes to the Earth.

Grades 9-Diploma

3.1.8 Students analyze the biological, physical, energy, and human interactions that shape and alter Earth Systems.

MATTER AND ENERGY**Grades Pre-K-2**

3.1.9 Students use observable characteristics to describe objects and materials and changes to physical properties of materials.

Grades 3-5

3.1.10 Students describe properties of objects and materials before and after they undergo a change or interaction.

Grades 6-8

3.1.11 Students describe physical and chemical properties of matter, interactions and changes in matter, and transfer of energy through matter.

Grades 9-Diploma

3.1.11 Students describe the structure, behavior, and interactions of matter at the atomic level and the relationship between matter and energy.

FORCE AND MOTION**Grades Pre-K-2**

3.1.12 Students describe how objects move in different ways.

Grades 3-5

3.1.12 Students summarize how various forces affect the motion of objects.

Grades 6-8

3.1.13 Students describe the force of gravity, the motion of objects and the nature of energy in light and waves.

Grades 9-Diploma

3.1.14 Students understand that the laws of forces and motion are the same across the universe.

3.2 THE LIVING ENVIRONMENT: Students understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection to create a great diversity of organisms, and that these organisms create interdependent webs through which matter and energy flow. Students

understand their similarities and differences, as humans, to other organisms and their interconnections to these interdependent webs.

BIODIVERSITY

Grades Pre-K-2

3.2.1 Students describe similarities and differences in the observable behaviors, features, and needs of plants and animals.

Grades 3-5

3.2.2 Students compare living things based on their behaviors, external features, and environmental needs.

Grades 6-8

3.2.3 Students differentiate among organisms based on biological characteristics, and identify patterns of similarity.

Grades 9-Diploma

3.2.4 Students analyze the evidence for relatedness among and within diverse populations of organisms, and the importance of biodiversity.

ECOSYSTEMS

Grades Pre-K-2

3.2.5 Students understand how plants and animals depend on each other and the environment they live in.

Grades 3-5

3.2.6 Students describe ways organisms depend upon, interact within, and change the living and nonliving environment as well as ways the environment affects organisms, biomes, and ecosystems.

Grades 6-8

3.2.7 Students examine how the characteristics of the physical, non-living (abiotic) environment, the types and behaviors of living (biotic) organisms, and the flow of matter and energy affect organisms and the ecosystem of which they are part.

Grades 9-Diploma

3.2.8 Students analyze the interactions, cycles, and factors that affect short and long-term ecosystem stability and change.

CELLS

Grades Pre-K-2

3.2.9 Students describe parts and wholes of living things, their basic needs, and the structures and processes that help them stay alive.

Grades 3-5

3.2.10 Students describe how living things are made up of one or more cells and the ways cells help organisms meet their basic needs.

Grades 6-8

3.2.11 Students describe the hierarchy of organization and function in organisms, and the similarities and differences in structure, function, and needs among and within organisms.

Grades 9-Diploma

3.2.12 Students describe structure and function of cells at the intracellular and molecular level including differentiation to form systems, interactions between cells and their environment, and the impact of cellular processes and changes on individuals.

HEREDITY AND REPRODUCTION**Grades Pre-K-2**

3.2.13 Students describe the cycle of birth, development, and death in different organisms and the ways in which organisms resemble their parents.

Grades 3-5

3.2.14 Students describe the length and stages of development in humans and other organisms, characteristics of organisms, and the reasons why organisms differ from or are similar to their parents.

Grades 6-8

3.2.15 Students describe the general characteristics and mechanisms of reproduction and heredity in organisms, including humans, and ways in which organisms are affected by their genetic traits.

Grades 9-Diploma

3.2.16 Students examine the role of DNA in transferring traits from generation to generation, in differentiating cells and in evolving new species.

EVOLUTION**Grades Pre-K-2**

3.2.17 Students describe similarities and differences between present day and past organisms that helped them live in their environment.

Grades 3-5

3.2.18 Students describe the fossil evidence and present explanations that help us understand why there are differences among and between present and past organisms.

Grades 6-8

3.2.19 Students describe the evidence that evolution occurs over many generations, allowing species to acquire many of their unique characteristics or adaptations.

Grades 9-Diploma

3.2.20 Students describe the interactions between species, populations and environments that lead to natural selection and evolution.

ADDENDUM:

Appendix A: The Maine *Learning Results* addressed in Appendix A, which serve as the basis for Maine's Grade Level Expectations, will remain in effect until the end of the 2007-2008 school year.

SECTION 1 - ENGLISH LANGUAGE ARTS

- A. PROCESS OF READING.** Students will use the skills and strategies of the reading process to comprehend, interpret, evaluate, and appreciate what they have read. *Readers apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts. They draw on prior experience, interactions with others, knowledge of word meaning and knowledge of other texts, word identification strategies, and understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Determine the meaning of unknown words by using a dictionary, glossary, or other reference sources.
- (c) Recognize when a text is primarily intended to persuade.

(3) MIDDLE GRADES 5-8

- (d) Use specific strategies (e.g., rereading, consultation) to clear up confusing parts of a text.
- (f) Identify accurately both the author's purpose and the author's point of view.
- (g) Summarize whole texts by selecting and summarizing important and representative passages.
- (h) Read for a wide variety of purposes (e.g., to gain knowledge, to aid in making decisions, to receive instructions, to follow an argument, to enjoy).

(4) SECONDARY GRADES

- (c) Analyze a text to interpret purpose. [Text complexity appropriate for grade 11.]
- (d) Identify the author's point of view and analyze the effects of that point of view on the text. [Text complexity appropriate for grade 11.]

- (e) Identify the devices an author uses to persuade readers and critique the effectiveness of the use of those devices. [Text complexity appropriate for grade 11.]
- (f) Use the context of a work to determine the figurative, idiomatic, and technical meanings of terms. [Text complexity appropriate for grade 11.]

B. LITERATURE AND CULTURE. Students will use reading, listening, and viewing strategies to experience, understand, and appreciate literature and culture. *Literary texts that are rich in quality, add to the understanding of history and various cultures and build an appreciation of the many dimensions (e.g., philosophical, ethical, aesthetic) of human experience.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (h) Understand how dialogue relates and contributes to a story or text.
- (j) Apply effective strategies to the reading and interpretation of fiction (e.g., fantasies, fables, myths, mysteries, realistic and historical fiction, adventures, and humorous tales) that is appropriately complex in terms of character, plot, theme, and dialogue and appropriately sophisticated in style, point of view, and use of literary devices.
- (k) Apply effective strategies to the reading and use of nonfiction (e.g., reference sources, articles, histories, biographies, autobiographies, diaries, and letters) using texts with an appropriate complexity of content and sophistication of style.

(3) MIDDLE GRADES 5-8

- (e) Demonstrate an understanding of lengthy, complex dialogues and how they relate to a story.
- (h) Apply effective strategies to the reading and interpretation of fiction (e.g., science fiction, myths, mysteries, realistic and historical fiction, poems, adventure stories, and humorous tales), using texts that are appropriately complex in terms of character, plot, theme, structure, and dialogue and appropriately sophisticated in style, point of view, and use of literary devices.
- (i) Apply effective strategies to the reading and use of moderately long nonfiction texts (e.g., reference sources, articles, editorials, histories,

biographies, autobiographies, diaries, letters, and commentaries) which have an appropriate complexity of content and sophistication of style.

(4) SECONDARY GRADES

- (b) Explain the simple and complex actions and interactions involving main and subordinate characters in a work. [Text complexity appropriate for grade 11.]
- (d) Interpret the effect of dialogues on the style of text. [Text complexity appropriate for grade 11.]
- (e) Identify and analyze the effects of details and effects of complex literary devices on text. [Text complexity appropriate for grade 11.]
- (g) Interpret fiction texts that are complex in terms of character, plot, theme, structure, and dialogue and sophisticated in style, point of view, and use of literary devices. [Text complexity appropriate for grade 11.]
- (h) Interpret nonfiction texts with appropriate complexity of content and sophistication of style. [Text complexity appropriate for grade 11.]
- (k) Examine and elaborate on a universal theme in text(s). [Text complexity appropriate for grade 11.]

D. INFORMATIONAL TEXTS. Students will apply reading strategies to informational texts across all areas of curriculum. *When reading critically, students will ask pertinent questions, recognize assumptions and implications, and evaluate information and ideas. In a world that surrounds them with information, they have to be able to connect with this information and make sense of it.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (b) Use of various informational parts of a text (e.g., index, table of contents, glossary, appendices).
- (c) Read for a variety of purposes (e.g., to answer specific questions, to form an opinion, to skim for information).
- (d) Summarize informational texts (e.g., identify the main idea or concept and the supporting detail).

(3) MIDDLE GRADES 5-8

- (d) Identify different ways in which informational texts are organized.
- (e) Produce and support generalizations acquired from informational text.

(4) SECONDARY GRADES

- (a) Determine whether a text contains relevant information. [Text complexity appropriate for grade 11.]
- (b) Distinguish between apparent fact and opinion in nonfiction texts. [Text complexity appropriate for grade 11.]
- (e) Analyze and synthesize the concepts and details in informational texts. [Text complexity appropriate for grade 11.]

SECTION 7 - MATHEMATICS

2. CONTENT STANDARDS AND PERFORMANCE INDICATORS

- A. NUMBERS AND NUMBER SENSE.** Students will understand and demonstrate a sense of what numbers mean and how they are used. *Numbers are used to describe and interpret phenomena. Building a sense of number relationships is essential for developing the ability to deal with any set of numbers. Number sense involves understanding the meaning of numbers, relationships among numbers, relative number magnitudes, and the effects of operations on numbers. Skilled estimation is also an important component of number sense.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Read, compare, order, classify, and explain whole numbers up to one million.
- (b) Read, compare, order, classify, and explain simple fractions through tenths.
- (c) Demonstrate knowledge of the meaning of decimals and integers and an understanding of how they may be used.

(3) MIDDLE GRADES 5-8

- (a) Use numbers in a variety of equivalent and interchangeable forms (e.g., integer, fraction, decimal, percent, exponential, and scientific notation) in problem-solving.
- (c) Apply concepts of ratios, proportions, percents, and number theory (e.g. primes, factors, and multiples) in practical and other mathematical situations.

(4) SECONDARY GRADES

- (a) Describe the structure of the real number system and identify its appropriate applications and limitations.

- B. COMPUTATION.** Students will understand and demonstrate **computation skills.** *Understanding the fundamental operations of addition, subtraction, multiplication, and division is central to knowing mathematics. Proficiency in computational skills is essential to problem-solving and other mathematical activities. Estimating, evaluating reasonableness of answers, and obtaining accuracy in calculations are included in this proficiency. Understanding relationships in operations allows students greater facility with*

mental computation. Computational skill promotes efficient and confident learners. Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Solve multi-step, real-life problems using the four operations with whole numbers.
- (b) Solve real-life problems involving addition and subtraction of simple fractions.
- (d) Develop proficiency with the facts and algorithms of the four operations on whole numbers using mental math and a variety of materials, strategies, and technologies.

(3) MIDDLE GRADES 5-8

- (a) Compute and model all four operations with whole numbers, fractions, decimals, sets of numbers, and percents, applying the proper order of operations.
- (b) Create, solve, and justify the solution for multi-step, real-life problems including those with ratio and proportion.

(4) SECONDARY GRADES

- (a) Approximate solutions, determine the reasonableness of answers, and justify the results.

C. DATA ANALYSIS AND STATISTICS. Students will understand and apply concepts of data analysis. *We are faced with massive quantities of information which must be selected, sorted, and analyzed to reach conclusions. Sound decision making requires the ability to collect data effectively, organize data, discover patterns, summarize trends, make inferences, draw conclusions, and make predictions. The ethical use of statistics is a paramount concern in the Information Age. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (b) Read and interpret displays of data.

(3) MIDDLE GRADES 5-8

- (a) Organize and analyze data using mean, median, mode, and range.

(4) SECONDARY GRADES

- (b) Predict and draw conclusions from charts, tables, and graphs that summarize data from practical situations.
- (c) Demonstrate an understanding of correlation and how it relates to data analysis.
- (d) Demonstrate an understanding of the idea of random sampling and recognition of its role in statistical claims and designs for data collection.

D. PROBABILITY. Students will understand and apply concepts of probability. *Probability is the study of uncertainty. Informed consumers of information understand the basic principles of probability. People need to understand the uncertainties and limitations involved when drawing conclusions from data.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (b) Estimate probability from a sample of observed outcomes and simulations.

(3) MIDDLE GRADES 5-8

- (a) Find the probability of simple events and make predictions by applying the theories of probability.
- (d) Find all possible combinations and arrangements involving a limited number of variables.

(4) SECONDARY GRADES

- (a) Find the probability of compound events and make predictions by applying probability theory.
- (b) Create and interpret probability distributions.

E. GEOMETRY. Students will understand and apply concepts from geometry. *Geometry is the study of the spatial world and its symmetries. The ideas of geometry are used to describe, interpret, represent, and change the spatial world in which we live. The understanding and development of spatial and visual skills strengthens problem-solving abilities.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Describe, model, and classify shapes and figures using applicable properties.

- (b) Experiment with shapes and figures to make generalizations regarding congruency, symmetry, and similarity.
- (c) Use transformations such as slides, flips, and rotations.

(3) MIDDLE GRADES 5-8

- (a) Compare, classify, and draw two dimensional shapes and three dimensional figures.
- (b) Apply geometric properties to represent and solve real-life problems involving regular and irregular shapes.
- (c) Use a coordinate system to define and locate position.

(4) SECONDARY GRADES

- (a) Draw coordinate representations of geometric figures and their transformations.
- (b) Use inductive and deductive reasoning to explore and determine the properties of and relationships among geometric figures.
- (c) Apply trigonometry to problem solving situations involving triangles.

F. MEASUREMENT. Students will understand and demonstrate measurement skills. *Measurement is valuable as an integrating skill throughout the curriculum and in everyday life. The use of estimation is vital in determining the reasonableness of measurement. Measurement attributes (e.g., length, volume, minutes), units, and tools enhance the ability to describe and understand the world. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (a) Solve and justify solutions to real-life problems involving the measurement of time, length, area, perimeter, weight, temperature, mass, capacity, and volume.
- (b) Select measuring tools and units of measurement that are appropriate for what is being measured.

(3) MIDDLE GRADES 5-8

- (a) Demonstrate the structure and use of systems of measurement.

- (b) Develop and use concepts that can be measured directly, or indirectly (e.g., the concept of rate).
- (c) Demonstrate an understanding of length, area, volume, and the corresponding units, square units, and cubic units of measure.

(4) SECONDARY GRADES

- (a) Use measurement tools and units appropriately and recognize limitations in the precision of the measurement tools.
- (b) Derive and use formulas for area, surface area, and volume of many types of figures.

G. PATTERNS, RELATIONS, FUNCTIONS. **Students will understand that mathematics is the science of patterns, relationships, and functions.** *Relationships are central to mathematical understanding. A study of patterns often reveals regularity, indicating the presence of a mathematical relationship. Studying relationships allows students to make generalizations and predictions about phenomena and occurrences.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Use the patterns of numbers, geometry, and a variety of graphs to solve a problem.
- (b) Use variables and open sentences to express relationships.

(3) MIDDLE GRADES 5-8

- (a) Describe and represent relationships with tables, graphs, and equations.
- (c) Use patterns and multiple representations to solve problems.

(4) SECONDARY GRADES

- (a) Create a graph to represent a real-life situation and draw inferences from it.
- (c) Model phenomena using linear, quadratic, and exponential functions.
- (d) Identify a variety of situations explained by the same type of function.

H. ALGEBRA CONCEPTS. **Students will understand and apply algebraic concepts.** *Algebra and analytic thinking are fundamental tools for working in and thinking about mathematics. These tools provide ways to generalize and*

predict problem solutions when not all information is known. Taught within the context of mathematical and practical applications, the concept of functions is a unifying theme for algebraic concepts. Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Develop and evaluate simple formulas in problem-solving contexts.
- (b) Find replacements for variables that make simple number sentences true.

(3) MIDDLE GRADES 5-8

- (a) Use the concepts of variables and expressions.
- (c) Analyze tables and graphs to identify properties and relationships in a practical context.
- (d) Use graphs to represent two-variable equations.
- (f) Find solutions for unknown quantities in linear equations and in simple equations and inequalities.

(4) SECONDARY GRADES

- (a) Use tables and graphs to interpret expressions, equations, and inequalities.
- (b) Recognize direct and inverse variation in equations, graphs, and data collections and solve problems involving direct and inverse variation.
- (c) Formulate and solve equations and inequalities.
- (d) Analyze and explain situations using symbolic representations.

- I. **DISCRETE MATHEMATICS. Students will understand and apply concepts in discrete mathematics.** *Discrete mathematics studies discrete processes (e.g., all possible bus routes in a school district). This study includes the exploration of diagrams, networks, and flowcharts that students construct to model situations or use for planning, scheduling, and decision making. Three main concerns of discrete mathematics are: existence (Is there a solution?), counting (How many solutions are there?), and efficiency (What is the best solution?). Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (a) Create and use organized lists, tree diagrams, Venn diagrams, and networks.

(3) MIDDLE GRADES 5-8

No performance indicator.

(4) SECONDARY GRADES

- (b) Use networks to find solutions to problems.
- (d) Use matrices as tools to interpret and solve problems.

J. MATHEMATICAL REASONING. Students will understand and apply concepts of mathematical reasoning. *Reasoning is fundamental to the knowing and doing of mathematics. To give more students access to mathematics as a powerful way of making sense of the world, it is essential that an emphasis on reasoning pervade all mathematics. Students need a great deal of time and many experiences to develop their ability to construct valid arguments in problem settings and to evaluate the arguments of others. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

No performance indicator.

(3) MIDDLE GRADES 5-8

No performance indicator.

(4) SECONDARY GRADES

- (a) Analyze situations where more than one logical conclusion can be drawn from data presented.

K. MATHEMATICAL COMMUNICATION. Students will reflect upon and clarify their understanding of mathematical ideas and relationships. *Communication plays a key role in helping make important connections among physical, pictorial, graphic, symbolic, verbal, and mental representations of mathematical ideas. Providing individual and collaborative opportunities for discussions about issues, people, and the cultural implications of mathematics reinforce student understanding of the connection between mathematics and our society. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (a) Use simple tables and graphs to communicate ideas and information in presentations in a concise and clear manner.

(3) MIDDLE GRADES 5-8

- (b) Use statistics, tables, and graphs to communicate ideas and information in convincing presentations and analyze presentations of others for bias or deceptive presentation.

(4) SECONDARY GRADES

- (a) Restate, create, and use definitions in mathematics to express understanding, classify figures, and determine the truth of a proposition or argument.

SECTION 5 - SCIENCE AND TECHNOLOGY

- A. CLASSIFYING LIFE FORMS. Students will understand that there are similarities within the diversity of all living things.** *Modern classification systems are based on comparisons of the structure, function, life-cycles, and behavior of organisms.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Group the same organisms in different ways using different characteristics.
- (d) Compare and contrast the life cycles, behavior, and structure of different organisms.

(3) MIDDLE GRADES 5-8

- (c) Describe some structural and behavioral adaptations that allow organisms to survive in a changing environment.

(4) SECONDARY GRADES

- (a) Explain the role of DNA in resolving questions of relationship and evolutionary change.
- (c) Analyze the basic characteristics of living things, including their need for food, water, and gases and the ability to reproduce.

- B. ECOLOGY. Students will understand how living things depend on one another and on non-living aspects of the environment.** *Balance in ecosystems is based on an intricate web of relationships among populations of living organisms and on non-living factors such as water and temperature. Changes in specific populations or conditions affect other parts of the ecosystem. Individual systems continually change in response to human and other factors.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Describe a food web and the relationships within a given ecosystem.
- (b) Explain the difference between producers (e.g., green plants), consumers (e.g., those that eat green plants), and decomposers (e.g., bacteria that break down the “consumers” when they die), and identify examples of each.

- (c) Compare and contrast physical and living components of different biomes - i.e., regions characterized by their climate and plant life - (e.g., tundra, rain forest, ocean, desert).

(3) MIDDLE GRADES 5-8

- (a) Describe in general terms, the chemical processes of photosynthesis and respiration.
- (b) Analyze how the finite resources in an ecosystem limit the types and populations of organisms within it.
- (d) Generate examples of the variety of ways that organisms interact (e.g., competition, predator/prey, parasitism/mutualism).

(4) SECONDARY GRADES

- (a) Illustrate the cycles of matter in the environment and explain their interrelationships.
- (b) Compare the process of photosynthesis and respiration, and describe the factors that effect them.

C. CELLS. Students will understand that cells are the basic units of life.

The functions performed by organelles (specialized structures found in cells) within individual cells are also carried out by the organ system in multi-cellular organisms. This standard requires that students be conversant with magnifying devices, cell structure and function, body systems, and disease causes and the body's defense against them. Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Demonstrate an understanding that a cell is the basic unit of living organisms.
- (d) Describe the functions of the major human organ systems.

(3) MIDDLE GRADES 5-8

- (d) Identify the causes and effects of diseases, explain their transmission, and identify prevention strategies.
- (e) Describe how body systems work together.

(4) SECONDARY GRADES

- (a) Relate the parts of a cell to its function.
- (b) Illustrate how cells replicate and transmit information, including the roles of DNA and RNA.
- (d) Explain how the human body protects itself against disease and how the body might lose that ability.

D. CONTINUITY AND CHANGE. Students will understand the basis for all life and that all living things change over time. *Fossils show past life, extinct species, and environmental changes over time. Organisms change and new species may arise due to genetically coded adaptations.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Identify present day organisms that have not always existed, and past life forms that have become extinct.
- (c) Explain how adaptations, in response to change over time, may increase a species' chances of survival.
- (d) Describe ways in which organisms may be similar to and different from their parents and explore the possible reasons for this.

(3) MIDDLE GRADES 5-8

- (b) Explain how scientists use fossils to prove that life forms, climate, environment, and geologic features in a certain location are not the same now as they were in the past.
- (d) Compare how sexually and asexually reproducing species transfer genetic information to offspring.

(4) SECONDARY GRADES

- (a) Explain how mutations can be caused by gene mutation or chromosomal alteration and describe the possible results of such mutations on individuals or populations.
- (g) Explain both the evidence used to develop the geologic time scale and why an awareness of geologic time is important to an understanding of the process of change in the universe as well as on earth.

E. STRUCTURE OF MATTER. Students will understand the structure of matter and the changes it can undergo. *Matter is made of atoms, each with characteristic properties, which can combine to form all substances in the*

universe. The state and properties of matter may differ when it experiences chemical, physical, and nuclear changes. Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (b) Explain how matter changes in both chemical and physical ways.

(3) MIDDLE GRADES 5-8

- (a) Predict and test whether objects will float or sink based on a qualitative and quantitative understanding of the concepts of density and buoyancy.
- (d) Describe how a substance can combine with different substances in different ways, depending on the conditions and the properties of each substance.
- (e) Describe how the motion of the particles of matter determines the state of that matter (e.g., solid, liquid, gas, plasma) and vice versa.
- (g) Investigate the similarities and differences between elements, compounds, and mixtures.

(4) SECONDARY GRADES

- (b) Analyze how matter is affected by changes in temperature, pressure, and volume.
- (d) Describe an application of the Law of Conservation of Matter.
- (e) Describe how atoms are joined by chemical bonding.
- (g) Describe nuclear reactions, including fusion, fission, and decay, their occurrences in nature, and how they can be used by humans.

F. THE EARTH. Students will gain knowledge about the earth and the processes that change it. *The earth's surface undergoes steady or sudden changes due to forces of wind, water, ice, volcanism, and shifting of tectonic plates. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (c) Describe differences among minerals, rocks and soils.
- (d) Illustrate how water and other substances go through a cyclic process of change in the environment.

(3) MIDDLE GRADES 5-8

- (a) Demonstrate how the earth's tilt on its axis results in the seasons.
- (b) Describe how soils are formed and why soils differ from one place to another.
- (d) Describe factors that can cause short-term and long-term changes to the earth.

(4) SECONDARY GRADES

- (a) Describe how air pressure, temperature, and moisture interact to cause changes in the weather.
- (b) Analyze potential effects of changes in the earth's oceans and atmosphere.
- (e) Demonstrate how rocks and minerals are used to determine geologic history.
- (f) Analyze the changes in continental position and the evidence that supports the concept of tectonic plates.

G. THE UNIVERSE. Students will gain knowledge about the universe and how humans have learned about it, and about the principles upon which it operates. *This includes understanding the result of the relative positions and movement of the earth, moon, sun, stars, planets, and galaxies. It also entails an understanding of how scientists gather data and formulate explanations for phenomena in space.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Illustrate the relative positions of the sun, moon, and planets.
- (b) Trace the sources of earth's heat and light energy to the sun.
- (c) Describe earth's rotation on its axis and its revolution around the sun.
- (d) Explore the relationship between the earth and its moon.

(3) MIDDLE GRADES 5-8

- (a) Compare past and present knowledge about characteristics of stars (e.g., composition, location, life-cycles) and explain how people have learned about them.

- (e) Describe the motions of moons, planets and stars.

(4) SECONDARY GRADES

- (a) Describe how scientists gather data about the universe.

H. ENERGY. Students will understand concepts of energy. *Energy takes many forms which can exert forces and do work. The conversion of energy from one form to another offers useful applications and sometimes presents problems.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Identify different forms of energy (e.g., light, sound, heat).

(3) MIDDLE GRADES 5-8

- (b) Demonstrate that energy cannot be created or destroyed but only changed from one form to another.
- (c) Compare and contrast the ways energy travels (e.g. waves, conduction, convection, radiation).
- (e) Categorize energy sources as renewable or non-renewable and compare how these sources are used by humans.

(4) SECONDARY GRADES

- (b) Examine and describe how light is reflected and refracted (deflected) by mirrors and lenses.
- (d) Analyze the relationship between the kinetic and potential energy of a falling object.
- (f) Describe the relationship between matter and energy and how matter releases energy through the processes of nuclear fission and fusion.

I. MOTION. Students will understand the motion of objects and how forces can change that motion. *All objects are in motion, at least at an atomic/subatomic level. By understanding how forces (e.g., gravity, friction, and magnetism) act on objects, they can predict their effects on the motion of the object.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (a) Describe the effects of different types of forces (e.g., mechanical, electrical, magnetic) on motion.
- (b) Draw conclusions about how the amount of force affects the motion of more massive and less massive objects.

(3) MIDDLE GRADES 5-8

- (a) Describe the motion of objects using knowledge of Newton's Laws.
- (b) Use mathematics to describe the motion of objects (e.g., speed, distance, time, acceleration).

(4) SECONDARY GRADES

- (c) Use Newton's Laws to qualitatively and quantitatively describe the motion of objects.
- (e) Explain the relationship between temperature, heat, and molecular motion.

J. INQUIRY AND PROBLEM SOLVING. Students will apply inquiry and problem-solving approaches in science and technology. *Scientific inquiry, problem solving, and the technological method provide insight into and comprehension of the world around us. A variety of tools, including emerging technologies assist, the inquiry processes. Models are used to understand the world. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (a) Make accurate observations using appropriate tools and units of measure.
- (b) Conduct scientific investigations: make observations, collect and analyze data, and do experiments.
- (c) Use results in a purposeful way: design fair tests, make predictions based on observed patterns and interpret data to make further predictions.

(3) MIDDLE GRADES 5-8

- (a) Make accurate observations using appropriate tools and units of measure.
- (b) Design and conduct scientific investigations which include controlled experiments and systematic observations. Collect and analyze data, and draw conclusions fairly.

- (c) Verify and evaluate scientific investigations and use the results in a purposeful way.

(4) SECONDARY GRADES

- (a) Make accurate observations using appropriate tools and units of measure.
- (b) Verify, evaluate, and use results in a purposeful way. This includes analyzing and interpreting data, making predictions based on observed patterns, testing solutions against the original problem conditions, and formulating additional questions.

K. SCIENTIFIC REASONING. Students will learn to formulate and justify ideas and to make informed decisions. *This involves framing and supporting arguments, recognizing patterns and relationships, identifying bias and stereotypes, brainstorming alternative explanations and solutions, judging accuracy, analyzing situations, and revising studies to improve their validity.* Students will be able to:

(2) ELEMENTARY GRADES 3-4

- (c) Draw conclusions about observations.
- (d) Use various types of evidence (e.g., logical, quantitative) to support a claim.
- (e) Demonstrate an understanding that ideas are more believable when supported by good reasons.

(3) MIDDLE GRADES 5-8

- (f) Support reasoning by using a variety of evidence.
- (h) Construct logical arguments.
- (i) Apply analogous reasoning.

(4) SECONDARY GRADES

- (c) Develop generalizations based on observations.
- (d) Determine when there is a need to revise studies in order to improve their validity through better sampling, controls or data analysis techniques.

- L. COMMUNICATION. Students will communicate effectively in the applications of science and technology.** *Clear and accurate communication employs appropriate symbols and terminology, models, and a variety of media and presentation styles. Communication includes constructing knowledge through reflection, evaluation, refocusing, and critically analyzing information from a variety of sources. Individuals and collaborative groups must communicate effectively. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (d) Make and/or use sketches, tables, graphs, physical representations, and manipulatives to explain procedures and ideas.
- (f) Cite examples of bias in information sources and question the validity of information from varied sources.

(3) MIDDLE GRADES 5-8

- (d) Make and use scale drawings, maps, and three-dimensional models to represent real objects, find locations, and describe relationships.

(4) SECONDARY GRADES

- (c) Make and use appropriate symbols, pictures, diagrams, scale drawings, and models to represent and simplify real-life situations and to solve problems.
- (d) Employ graphs, tables, and maps in making arguments and drawing conclusions.

- M. IMPLICATIONS OF SCIENCE AND TECHNOLOGY. Students will understand the historical, social, economic, environmental, and ethical implications of science and technology.** *Scientific and technological breakthroughs are influenced by prevailing beliefs and conditions which in turn are impacted by new ideas and inventions. By assessing the impacts of technological activity on the environment, students will develop their own sense of global stewardship. Students will be able to:*

(2) ELEMENTARY GRADES 3-4

- (c) Explore how technology (e.g., transportation, irrigation) has altered human settlement.
- (d) Explain practices for conservation in daily life, based on a recognition that renewable and non-renewable resources have limits.

(3) MIDDLE GRADES 5-8

- (d) Describe an individual's biological and other impacts on an environmental system.
- (f) Give examples of actions which may have expected or unexpected consequences that may be positive, negative, or both.

(4) SECONDARY GRADES

- (b) Demonstrate the importance of resource management, controlling environmental impacts, and maintaining natural ecosystems.
- (d) Analyze the impacts of various scientific and technological developments.